



Ministry of
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Provincial Highways

Guidelines for Acceptance Sampling and Testing of Granular Materials

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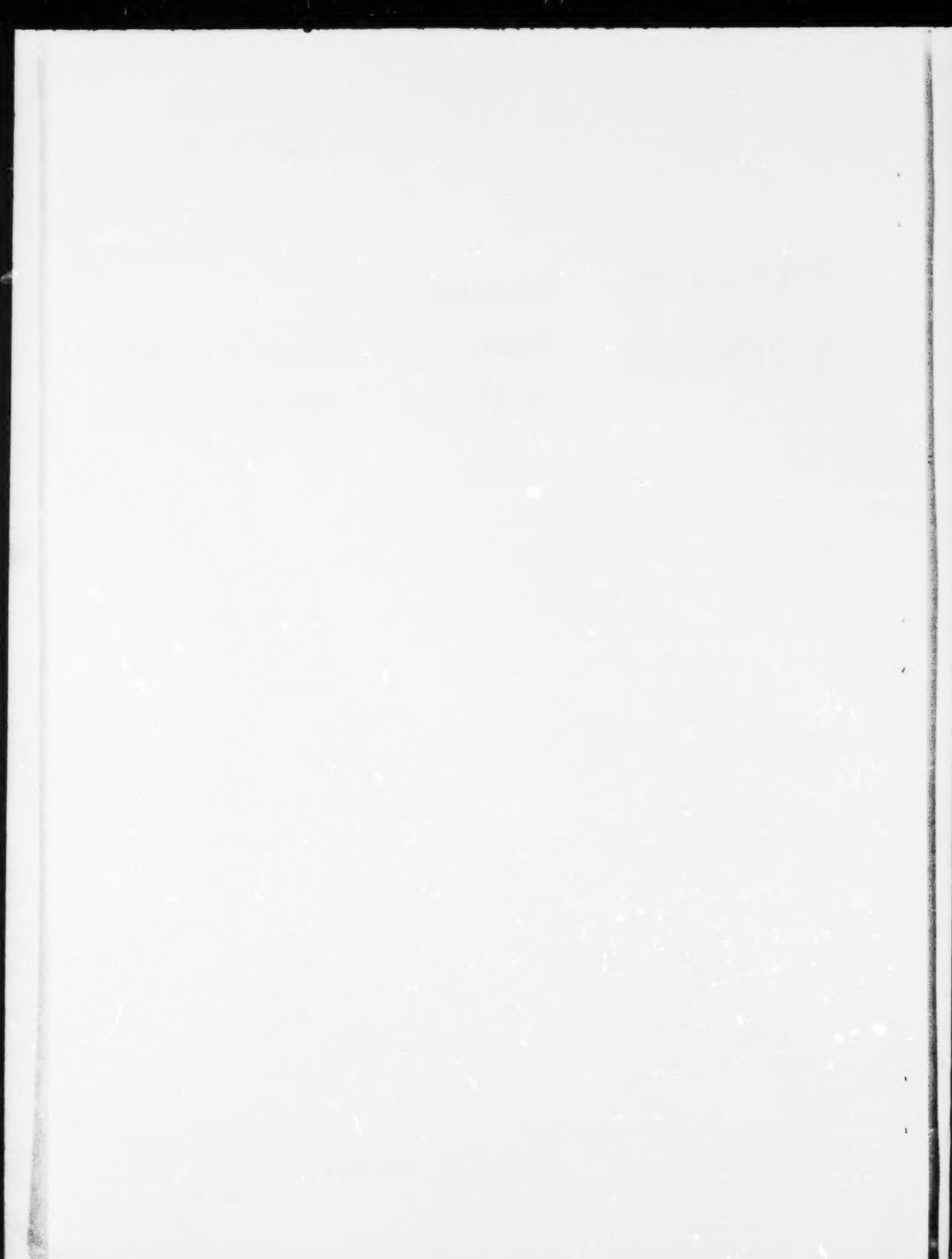


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GUIDELINES FOR ACCEPTANCE SAMPLING AND TESTING OF GRANULAR MATERIALS

1. GENERAL

Sampling is as important as testing, and the sampler must use every precaution to obtain samples that will show the TRUE nature and condition of the materials which they represent.

The true nature of materials may best be secured by unbiased samples taken in a random manner as required by the 1983 Guidelines and the Special Provisions on Granular A, B and M. Aggregates, being composed of mixtures of unlike sizes, tend to separate or segregate. For this reason samples to be taken for acceptance testing of gradation, should be obtained at the last practical point before the material is incorporated into the finished product.

The above special provisions identify three acceptable locations for sampling, namely (a) from the road (road samples); (b) at the location of loading the trucks (delivery samples); and (c) from the delivery vehicle (truck samples).*

The special provisions also state that the actual location of sampling will be determined by the Engineer (i.e. the Project Supervisor). Prior to the delivery and placing of the particular aggregate the Project Supervisor should decide whether it is possible and economical to carry out road sampling, since this is the preferred location. There may be occasions however, when road sampling will not be practical or economical. Examples of the latter are such contracts where the aggregate is placed in various locations in small quantities, or the material is spread in very thin lifts, that cannot be properly sampled. In some cases the field laboratory may be at or near the aggregate plant, so that road sampling would result in extra expenditures. In the above or in similar situations the Project Supervisor will specify delivery sampling.

*NOTE: During the 1983 construction season samples taken during production of a stockpile and from an existing stockpile, with some limitations, will still be permitted.

Truck sampling is envisaged in exceptional cases only where neither road nor delivery sampling is deemed to be practical. Regardless of which sampling location is chosen the Contractor should be advised in writing prior to the use of delivery or road samplings.

Occasionally the contractor or his supplier will indicate that, in his opinion, the sampling or testing of granular materials is not being carried out in accordance with the contract and/or with Ministry policy. If this occurs, the Project Supervisor should ask the contractor to write to the Regional Manager of Construction detailing the concerns. The Manager will initiate an investigation and discuss the concerns with the Contract Management Office and the Engineering Materials Office before responding to the Contractor.

The purpose of these guidelines is to outline the frequency of sampling, the random selection of sample location and the actual method of taking samples at the accepted locations. The guidelines also contain a list of sample and test portion sizes and give some important checkpoints for gradation and % crushed testing.

2. THE FREQUENCY OF SAMPLING

The frequency of sampling is governed by the size of the lot. Since the lot is divided into four equal sublots, the minimum frequency of sampling is one sample for each sublot of aggregate.

The definition of a lot is a specific quantity of material that is produced by the same process. In the Special Provisions the choice of the lot size is left to the discretion of the Project Supervisor; however, the lot size must be less than 4000 t during the early stages of production. After four consecutive lots have been accepted at the contract price, the Project Supervisor may increase the lot size to 10 000 t for Granular A and Granular M and to 20 000 t for Granular B. Increasing the lot size should be reserved for those exceptional cases where the material has a consistent gradation. The contractor should be advised if the lot size is increased to more than 4000 t.

Since each lot is decisioned separately for acceptance, rejection or an adjusted payment, it is necessary to keep an accurate record of the quantities in each lot. The weigh tickets provide an excellent record that should be used for this purpose.

The first task in setting up a sampling plan is to establish the basis for the size of the subplot. As long as the quantity of aggregates within a subplot is equal to or less than that specified by the Special Provision the subplot can be defined by the time duration it takes to deliver, by the number of truck loads necessary for the haulage or by the area covered by the material.

3. RANDOM SAMPLING PROCEDURE

3.1 Random Number Tables

After the size of the subplot has been determined (e.g. four hours of delivery time, 34 truck loads etc.) one sample should be obtained from each subplot in a stratified random manner.

Random sampling means choosing samples in such a manner that each portion in the lot has an equal probability of being selected (also called probability sampling.).

Stratified sampling means dividing a lot into two or more approximately equal portions and obtaining one sample from each portion. In determining the random time, truck load or location, Random Number Tables must be used. A random number table is a list of numbers chosen at random from an infinite population of numbers. Some examples of random number tables are given in the Appendix. In the tables the decimal numbers are grouped in sets of four to facilitate their use for four tests per lot. In selecting numbers for random sampling a pencil or pen should be stabbed onto a sheet of random numbers with the eyes closed. The group of numbers closest to the picked location should be chosen for the first lot. Successive random numbers should be picked by following a systematic pattern until all the numbers are used. If more random numbers are required the above procedure should be repeated, using another table.

3.2 Random Sampling on Time Basis

This method will be used when it is more practical to estimate the time it will take the contractor to load, or to deliver to the work, the quantity of aggregate representing a lot.

If, for instance, it is estimated that during the following two days the Contractor will load or deliver about 3000 t of the particular material, this time may be used as a lot. One subplot thus will contain 750 t. If the working time in two days is say 16 hours, one subplot will

take about four hours or $4 \times 60 = 240$ minutes. The two days will then be divided into the four subplot times as follows: First day 8 am to 12 noon=first subplot; 1 pm to 5 pm=second subplot; second day 8 am to 12 noon=third subplot; 1 pm - 5 pm=fourth subplot.

By the method described earlier the Inspector selects a group of four random numbers and each of these numbers is multiplied by the time in minutes required for one subplot, in this case 240 minutes. Since all random numbers are decimal digits the products of the multiplication will always be less than the total time of one subplot. The four products are added to the starting times of each subplot, giving the random times for the samples. In our example if the random numbers picked were: .584, .216, .233 and .805 the products and the actual sampling times will be as follows:

Sublot		Sublot	
		Starting Time	Sampling Time
1st	$.584 \times 240 = 140 \text{ min.}$	8 am	10:20 am
2nd	$.216 \times 240 = 52 \text{ min.}$	1 pm	1:52 pm
3rd	$.233 \times 240 = 56 \text{ min.}$	8 am	8:56 am
4th	$.805 \times 240 = 193 \text{ min.}$	1 pm	4:13 pm

The samples should be taken as close as possible to the times given by the random numbers.

The above method will be fairly easy in the case of continuous, uninterrupted haulage. When the delivery is intermittent or irregular, which is often the case, it will be difficult to predetermine the time necessary to load the material for one lot. In the latter situation the time of a lot should be estimated by assuming a frequency of loading that would not likely be exceeded.

Let us assume that with irregular delivery there will not likely be more than 2000 t delivered in one day. The lot size then can be established as two days delivery. By the method, explained earlier in this section the random times for sampling should be calculated, preferably for more than one day. (For the whole week if practical). Now at the time of sampling, the Inspector arrives at the appropriate place and if there is no truck at the determined time, or within a reasonable waiting period, he may skip one sample and extend the time for the lot accordingly. If this practice is employed we can be sure that the actual size of the lot will never be larger than the allowable maximum size of 4000 t. After the sampling and testing is completed the actual lot

size must be determined by computing, from the weigh tickets, the quantity of material delivered for the applicable time period.

3.3 Random Sampling on Quantity (tonnage) Basis

In those situations when it is simpler to determine the lot size by the number of truck loads necessary for haulage, random samples may be selected according to the truck load. This method will require close communication between the sampler and the weighmen and checker especially if delivery is intermittent. The procedure for this sampling plan would be as follows:

Determine how many truck loads are required to haul the aggregate representing one lot. If the maximum size of the lot of 4000 t is used, and the average load of a truck is 30 t, then one lot will consist of roughly 132 truck loads. The sublots will also be determined by the number of trucks so that the first subplot is represented by the first 33 loads, the second by trucks 34 - 66, the third by the 67 - 99 and the fourth by the 100 - 132 loads. Now the selected random numbers will be multiplied by the number of truck loads in a subplot to establish the particular truck from where the random sample should be obtained. Assuming that the random numbers are: .217, .181, .721 and .347 the computation is:

		Starting Truck Load	Sampled Truck Load
1st	$.217 \times 33 =$	1st	7th
2nd	$.181 \times 33 =$	34th	39th
3rd	$.721 \times 33 =$	67th	90th
4th	$.347 \times 33 =$	100th	110th

In the event this plan is used for truck samples, sampling will be carried out from the truck. In the case of road sampling the sample will be collected from the truck load after it was placed in the work but prior to compaction. For delivery samples the sample will be obtained as the randomly selected truck is loaded. As in the case of Random Sampling on a Time Basis, the actual lot size should be determined from weigh records.

3.4 Random Sampling on Area Basis

The exact location of a sample within a certain area should be determined by two random numbers picked from a random number table. This method will be used for road sampling to establish the location of the sample within the

area covered by the placed and spread truck load.

The same procedure will define the sampling location of delivery samples within the placed and levelled load of the front end loader. In carrying out truck sampling the two random numbers will pinpoint the location within the surface area of the truck box.

As an example let us take the case where road sampling was decided and the selected truck placed Granular A aggregates in a road widening. The load was placed 2 m wide, 45 m long with an uncompacted thickness of 150 mm. The two random numbers chosen are: .406 and .035. The first number will be used to determine the longitudinal distance from the beginning of the spread material and the second number will again determine the offset from the edge of the layer. The calculation is:

$$\begin{aligned} \text{The sample location} &= .406 \times 45 = 18.3 \text{ m} \\ &\text{from the starting edge} \\ &\text{and} \\ &.035 \times 2 = 0.07 \text{ m} \\ &\text{(7 cm) offset from edge.} \end{aligned}$$

(An example of delivery sampling is shown in Figure 2).

4. SAMPLING TECHNIQUES

4.1 General

Whether road, delivery or truck sampling has been decided by the Engineer, the actual procedure for obtaining a sample must be strictly adhered to.

All samples must be taken and submitted for testing by authorized personnel of the Ministry.

When sampling aggregates for gradation testing the following equipment is required:

- (a) Tile spade with attached side walls.
- (b) Sample bags clean of particles from previous sample.
- (c) Sample data sheets and tags.
- (d) Tape measure.

Sampling techniques explained in the next paragraphs apply to one sample (subplot), and must be repeated four times to complete a lot. It is important that road, delivery or truck samples are not mixed within sampling one particular lot, unless there is no other way to complete the lot, or where necessary when retesting a lot.

4.2 Road Sampling

Road sampling should be performed after the aggregates have been placed and spread but prior to compaction. Either the random time method or the random quantity method may be used to select the portion of aggregate to be sampled. In the case of random time, the sample shall be taken from the material of the first truck arriving after the calculated time. The exact location of the sample should be determined by the random area method, by measuring out the longitudinal position and the offset distance indicated by the picked and recorded random numbers.

Take the sample from the designated area by using the sample bag as a template. Always place the bag so that the longer side is at right angles to the direction in which the truck was moving. If the random numbers fall too close to the edge, then sample from the edge towards the middle of the dumped area.

Obtain the sample by lifting the material with the tile spade from the full depth of the layer being careful not to include any material from the underlying layer. However for thin layers it may be necessary to increase the size of the template. Do this by staying parallel to the original template lines.

Never shake or jiggle the spade to remove excess material when filling the sample bag, because this may eliminate mainly the coarse portion of the sample.

No attempt must be made to select or avoid obvious areas where segregation, dirt or any other fault in the material may be evident and the sample must be taken where the random numbers direct. If the contractor is placing material in a manner which does not allow road sampling, then he will either have to change his method of operation or another sampling method will have to be selected.

While the inspector is establishing the exact position of the point where the sample is to be taken and while taking the sample the contractor must stay clear of the area. The area has to be undisturbed by any equipment until the sample has been taken.

The minimum mass of a sample must be in accordance with the requirements given in Section 5 of these guidelines.

The execution of road sampling is shown in Figure 1.



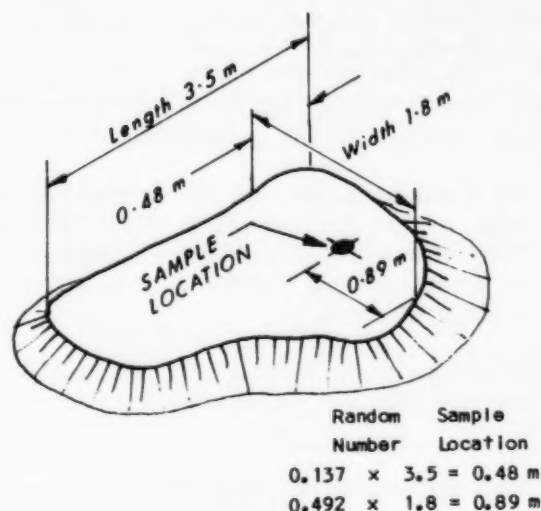
Obtaining a road sample of Granular A.
FIGURE 1.

4.3 Delivery Sampling

Delivery Sampling is carried out at the location where the trucks are being loaded from a stockpile or from a uniform pit face of Granular B type I aggregate. Delivery samples should not be taken at those locations where Granular B aggregates are loaded directly from a variable pit face. It is realized that some judgement will be necessary by the inspector in determining whether or not a pit face is uniform. If the inspector feels that the gradation of the material is similar along the open pit face, he will assess the face as being uniform. Examples of uniform pit faces are predominantly sand deposits or stratified materials, having horizontal layers of finer and coarser strata. If, however the open face of a pit exhibits irregular stratification with pockets, random seams and lenses of dissimilar material, the face will be deemed variable. In the latter case road sampling should be chosen.

For delivery sampling either the random time or the random quantity method may be used to select that portion of the aggregate to be sampled. The procedure for securing a delivery sample is as follows: As the selected truck is being loaded (in the case of random quantity) or at the random time (in the case of random time method) the operator of the front end loader should place the next bucketful of material on the ground. The material is then levelled by back-blading it with the bucket, so that the thickness of the levelled off aggregate is between 0.3 m and 0.5 m

The levelled surface of the load is usually oblong in shape and somewhat irregular. Nevertheless the actual location of the sample within the levelled surface should be decided by the random area method (Section 3.4). Because of the irregular area, some judgement will be necessary to define the longitudinal and transverse extent of the load. Figure 2 shows a sketch, indicating the above procedure.



Sketch showing random delivery sample location.
FIGURE 2.

Obtain the sample from the location given by the picked random numbers, by excavating the material as deep as possible with the tile spade, making sure that the sample is not mixed with the underlying soil. In Figure 3 a photograph of delivery sampling is given.



Taking a delivery sample of Granular A.
FIGURE 3.

4.4 Truck Sampling

Truck sampling will be carried out only in those cases where neither road nor delivery sampling is possible.

When truck sampling is used the portion to be sampled may be decided by the random time or the random quantity (truck) method. The truck designated by the random number may be sampled at the weigh scale, when it leaves the pit or at the job site. The actual locations of the samples should be calculated for one or more lots prior to the start of delivery. Two random numbers should be picked for each sublot, one determining the longitudinal, the second the transverse location on the truck.

Secure the sample from the point directed by the random number by digging with the tile spade, within an area about the same size as a sample bag, until the appropriate mass of the sample is obtained.

4.5 Sampling During Stockpiling

Since truly random sampling cannot be done on a stockpile after it is built, this kind of sampling for acceptance purposes is not allowed.

The special provisions for Granular A and Granular M however permit sampling these aggregates as they are placed in stockpile in those cases where the contract contains an item for construction of a stockpile.

NOTE: During the 1983 construction season sampling during stockpiling will be permitted except in conditions where it has not been allowed in previous years. In 1983 samples will also be allowed to be taken from an existing stockpile containing 4000 t of material or less. Larger stockpiles may be sampled only if they can be subdivided into 4000 t (lot size) portions. A large conical stockpile therefore can not be sampled. It is re-emphasised that truly random samples cannot be obtained from a stockpile, after it is built. (The centre of the pile has no probability of being sampled.) Nevertheless, the Inspector should make every effort to obtain unbiased samples from existing stockpiles during 1983. Samples from existing stockpiles should be obtained by excavating into the stockpile with appropriate equipment.

To determine the load to be sampled random sampling on a time or quantity basis may be used. At the randomly determined time or quantity the material last placed in the stockpile should be sampled. The material should be separated from the bulk of the stockpile by a bulldozer, front end loader or similar equipment, placed on the ground and levelled. The exact location of sample and the method of sampling within the levelled off load will be the same as described for delivery sampling (Sect. 4.3).

5. SAMPLE AND TEST PORTION SIZE

In order to obtain the desired level of confidence in the test results, each field sample must contain a sufficient mass of material. The size of field samples depends on the maximum size of the relevant specification as given by the ASTM Standard D75-82.

In the laboratory, the field sample should be reduced to test portion sizes by use of a mechanical sample splitter. The minimum test portion sizes of the various aggregates are specified by ASTM Standard C136-81

The minimum mass of field samples and test portions after drying, for the various aggregates is tabulated below:

Type of Aggregate	Minimum Field Sample Mass (kg)	Minimum Test Portion Mass (kg)
Granular A Type I	35	5
Granular A Type II	25	2
Granular B Type I	60	10
Granular B Type II	60	10
Granular M	25	2

NOTE: If the maximum grain size in a granular B deposit is 26.5 mm or smaller, the sample size may be reduced to 25 kg and the test portion size to 2 kg.

The mass of fine aggregates (passing 4.75 mm) for the sieve analysis should weigh after drying approximately 250 g. If the fine aggregate portion of the sample is very uniformly graded, the test portion for washing may be reduced to 125 g, to prevent overloading of the sieves.

6. GRADATION TESTING OF AGGREGATES (Highlights & Requirements)

a) If there are only a few particles of a granular B deposit larger than 106 mm, these particles should be removed from the work by the contractor. If this is not practical, the percentage of oversize particles should be calculated on the total mass of the field sample (60 kg). This may be accomplished by sieving the entire sample through a 106 mm sieve. Adjustment points for the oversize material should be based on the above calculation.

b) Reduce original sample to the required testing size by splitting or quartering.

USE A MECHANICAL SPLITTER HAVING A MINIMUM OF 8 EQUAL CHUTES WITH OPENINGS AT LEAST 50% LARGER THAN THE MAXIMUM PARTICLE SIZE. TEST PORTION SIZE TO BE AS CLOSE AS POSSIBLE TO THE RECOMMENDED SIZES IN SECTION 5.

c) Dry the sample test portion, weigh and record the dry mass in brackets on the computation sheet.

THIS INITIAL MASS OF TOTAL SAMPLE WILL NOT BE USED FOR CALCULATION PURPOSES IN 1983, BUT WILL BE A CHECK POINT AS EXPLAINED LATER.

d) Place sample in a mechanical shaker equipped with a nest of coarse sieves and vibrate for 8 minutes.

USE A MECHANICAL SHAKER USING THE SIEVES SHOWN BELOW. ONLY THE UPPER SIEVE REQUIRES TO BE CHANGED TO MEET THE SPECIFICATIONS FOR ALL GRANULAR TYPES.

SIEVES TO BE USED IN MECHANICAL SHAKERS				
GRANULAR A		GRANULAR B		GRANULAR M
TYPE I	TYPE II	TYPE I	TYPE II	
37.5	22.4	26.5	26.5	
19.0	19.0	19.0	19.0	19.0
13.2	13.2	13.2	13.2	13.2
9.5	9.5	9.5	9.5	9.5
4.75	4.75	4.75	4.75	4.75
PAN	PAN	PAN	PAN	PAN

Note: Bold numerals indicate specification sieves.

e) Weigh and record cumulatively the mass retained on each specified sieve.

f) Add the mass retained 4.75 mm and the mass passing 4.75 mm material for the mass of total sample.

THERE IS A PROBABILITY OF PARTICLE LOSS DURING SIEVING, CAUSING A TESTING ERROR. THE MASS OF TOTAL SAMPLE AS CALCULATED IN (f) ABOVE SHOULD BE CHECKED AGAINST THE INITIAL TOTAL MASS PRIOR TO SIEVING AS IN (c). IF THERE IS A LOSS OF MATERIAL GREATER THAN 1%, THE EQUIPMENT AND PROCEDURE SHOULD BE CHECKED AND CORRECTED TO MINIMIZE FURTHER ERROR. SEE EXAMPLE BELOW.

Calculate mass as in (f)
initial dry mass as in (c)

ALL MASSES FOR DRIED SAMPLE		SUBLOT 1
(A) MASS TOTAL SAMPLE	lb (kg)	(7.361) 7.301
(B) MASS RETAINED 4.75 mm SIEVE	lbs (kg)	3.559
(C) MASS PASSING 4.75 mm SIEVE	lbs (kg)	3.742
(D) % COARSE AGGREGATE	$\frac{B}{A} \times 100$	48.7
(E) % FINE AGGREGATE	$\frac{C}{A} \times 100$	51.3

COARSE AGGREGATE CUMULATIVE MASS	MINISTRY SIEVE	(X) MASS	% PASSING $\frac{A-X}{A} \times 100$
	37.5 mm	0	100
	19.0 mm	0.264	96.4
	9.5 mm	2.342	67.9
	4.75 mm	3.559	51.3

$$\frac{c-f}{c} \times 100 = \% \text{ loss}$$

$$\frac{7.361-7.301}{7.361} \times 100 = 0.8\% \text{ loss}$$

g) Reduce pass 4.75 mm material (pan portion) by splitting to approximately 250 g sample size (fine aggregate).

USE A FINE AGGREGATE SPLITTER HAVING AT LEAST 12 EQUAL WIDTH CHUTES WITH OPENINGS APPROXIMATELY 50% LARGER THAN THE LARGEST PARTICLE .

h) Weigh and record the mass of fine aggregate before carrying out the washing procedures.

i) Perform the washing, dry the sample, record the dry mass.

j) Place the dried sample in a mechanical shaker equipped with a nest of fine sieves and vibrate for 8 minutes.

USE A MECHANICAL SHAKER WITH ADDITIONAL SIEVES AS REQUIRED BETWEEN THE SPECIFIED SIEVES TO PREVENT OVERLOADING OF ANY ONE SIEVE.

k) Weigh and record cumulatively the mass retained on each specified sieve.

7. PERCENT CRUSHED TESTING OF AGGREGATES

a) If a Percent Crushed determination is required, retain coarse aggregate portion of the sample after coarse sieving operation. [THIS INCLUDES ALL MATERIAL RETAINED ON EACH COARSE AGGREGATE SIEVE (MASS RETAINED 4.75 mm SIEVE)].

b) Reduce coarse aggregate portion by splitting to approximately 800 - 1000 g sample.

c) Weigh and record the mass of the percent crushed sample.

d) Weigh and record crushed particles.

A CRUSHED PARTICLE IS DEFINED AS A PIECE OF COARSE AGGREGATE WHICH HAS AT LEAST ONE FRACTURED AND WELL DEFINED FACE.

e) Calculate the percent crushed.

(AFTER TWO LOTS HAVE BEEN COMPLETED AND THE TEST RESULTS INDICATE THAT THE PERCENT CRUSHED IS GREATER THAN 65% THE NUMBER OF PERCENT CRUSHED TESTS MAY BE REDUCED TO TWO OR THREE TESTS FOR EACH SUBSEQUENT LOT.)



APPENDIX
RANDOM NUMBER TABLES

RANDOM NUMBER TABLES

.784	.419	.496	.821	.029	.032	.851	.960	.006	.418
.078	.134	.763	.519	.842	.126	.383	.915	.743	.138
.323	.913	.378	.954	.315	.809	.298	.362	.277	.744
.950	.365	.675	.357	.110	.403	.153	.239	.273	.242
.264	.512	.245	.696	.111	.721	.822	.137	.537	.517
.418	.153	.931	.360	.730	.995	.307	.703	.617	.674
.424	.646	.172	.883	.676	.254	.699	.206	.630	.527
.617	.307	.543	.118	.235	.861	.615	.943	.327	.691
.844	.968	.716	.872	.770	.162	.293	.851	.130	.703
.214	.346	.047	.208	.831	.790	.761	.389	.625	.815
.687	.823	.611	.982	.545	.669	.481	.539	.074	.515
.640	.135	.262	.048	.246	.642	.491	.536	.295	.805
.256	.699	.012	.958	.190	.014	.661	.705	.760	.818
.193	.208	.957	.666	.284	.848	.260	.169	.763	.358
.071	.483	.274	.352	.549	.250	.820	.535	.933	.803
.612	.710	.710	.785	.884	.466	.981	.446	.219	.357
.410	.026	.354	.196	.556	.407	.389	.766	.981	.974
.541	.466	.682	.936	.644	.987	.064	.528	.711	.491
.860	.726	.295	.830	.430	.070	.963	.574	.436	.452
.625	.118	.645	.665	.430	.990	.164	.049	.808	.508
.486	.757	.554	.917	.543	.482	.711	.186	.494	.423
.874	.856	.764	.765	.820	.250	.879	.521	.445	.741
.285	.395	.786	.882	.667	.319	.162	.486	.895	.266
.596	.153	.584	.793	.635	.763	.378	.768	.059	.177
.271	.267	.181	.488	.585	.136	.884	.807	.809	.732
.020	.974	.241	.398	.582	.588	.899	.042	.770	.030
.359	.139	.213	.854	.283	.718	.828	.991	.143	.253
.668	.385	.911	.526	.261	.597	.523	.418	.057	.226
.203	.985	.708	.066	.749	.526	.803	.169	.513	.221
.258	.639	.093	.404	.285	.501	.079	.283	.185	.525
.644	.867	.172	.607	.406	.653	.099	.608	.710	.770
.507	.374	.038	.570	.671	.067	.558	.743	.155	.196
.841	.393	.553	.059	.459	.006	.047	.846	.151	.036
.717	.373	.823	.559	.457	.011	.701	.416	.370	.147
.226	.482	.964	.326	.278	.757	.233	.997	.784	.545
.757	.174	.421	.616	.834	.757	.174	.935	.985	.464
.013	.482	.264	.882	.766	.260	.730	.259	.591	.781
.321	.105	.571	.216	.842	.668	.061	.689	.339	.396
.929	.491	.517	.230	.065	.391	.069	.797	.735	.396
.430	.963	.270	.442	.715	.741	.113	.003	.627	.140

RANDOM NUMBER TABLES

.318	.801	.435	.202	.745	.489	.900	.027	.827	.279
.922	.683	.847	.320	.478	.421	.893	.826	.444	.619
.726	.473	.854	.662	.381	.761	.661	.866	.174	.799
.711	.341	.219	.228	.466	.683	.676	.374	.502	.469
.978	.631	.469	.885	.267	.510	.601	.135	.290	.025
.689	.152	.703	.544	.742	.335	.670	.034	.007	.590
.515	.351	.824	.856	.347	.792	.543	.590	.052	.713
.960	.690	.343	.019	.917	.879	.364	.271	.942	.355
.991	.520	.165	.043	.448	.626	.526	.926	.607	.827
.713	.766	.812	.496	.626	.770	.332	.770	.663	.200
.131	.266	.141	.919	.199	.510	.332	.546	.762	.991
.977	.697	.704	.305	.831	.740	.050	.926	.239	.392
.681	.627	.035	.023	.335	.790	.623	.673	.509	.480
.106	.702	.879	.408	.519	.929	.416	.584	.486	.818
.635	.427	.554	.288	.329	.933	.855	.858	.059	.851
.506	.672	.434	.162	.060	.375	.025	.415	.868	.637
.298	.057	.960	.411	.441	.565	.171	.693	.054	.065
.817	.663	.359	.038	.653	.001	.321	.506	.886	.920
.764	.580	.967	.071	.286	.351	.950	.098	.539	.793
.493	.205	.698	.182	.504	.687	.005	.814	.951	.326
.314	.496	.174	.924	.886	.170	.495	.431	.835	.546
.308	.360	.103	.151	.234	.927	.088	.981	.439	.444
.412	.097	.321	.233	.725	.434	.429	.919	.575	.493
.178	.245	.433	.486	.622	.175	.238	.108	.647	.215
.847	.387	.434	.285	.515	.980	.261	.980	.755	.058
.574	.039	.679	.471	.775	.986	.536	.834	.060	.754
.648	.461	.014	.064	.176	.867	.484	.794	.388	.890
.764	.412	.577	.523	.060	.329	.655	.313	.382	.134
.899	.070	.117	.270	.914	.048	.584	.566	.099	.314
.792	.356	.793	.143	.640	.267	.216	.824	.367	.886
.486	.886	.430	.327	.315	.988	.233	.880	.244	.936
.760	.328	.874	.960	.989	.426	.805	.934	.717	.880
.833	.122	.911	.217	.136	.907	.322	.090	.216	.392
.557	.997	.727	.181	.510	.704	.349	.505	.864	.872
.244	.180	.057	.721	.349	.629	.780	.065	.125	.721
.546	.572	.623	.347	.550	.472	.608	.325	.426	.001
.596	.533	.616	.678	.030	.197	.939	.806	.441	.212
.440	.559	.286	.750	.823	.928	.004	.225	.776	.384
.339	.388	.357	.764	.624	.170	.448	.564	.383	.310
.755	.918	.791	.329	.414	.149	.699	.172	.156	.482

RANDOM NUMBER TABLES

.511	.455	.333	.087	.021	.048	.265	.798	.430	.374
.941	.656	.537	.385	.994	.813	.012	.823	.502	.839
.673	.721	.637	.123	.748	.661	.372	.018	.242	.837
.623	.125	.748	.141	.648	.768	.933	.514	.969	.321
.498	.162	.692	.878	.474	.159	.751	.130	.691	.831
.732	.909	.181	.055	.139	.911	.113	.100	.178	.358
.336	.031	.853	.660	.417	.154	.051	.984	.881	.607
.652	.347	.261	.626	.778	.667	.321	.987	.404	.102
.815	.058	.941	.981	.743	.420	.400	.864	.713	.402
.567	.607	.476	.857	.120	.358	.313	.226	.091	.065
.651	.121	.116	.621	.112	.937	.329	.497	.328	.416
.380	.110	.905	.074	.450	.293	.238	.992	.534	.468
.117	.790	.119	.214	.868	.562	.163	.630	.185	.112
.386	.342	.174	.450	.134	.503	.421	.835	.608	.458
.871	.935	.699	.516	.937	.904	.437	.504	.300	.379
.967	.401	.487	.070	.959	.912	.706	.703	.431	.361
.035	.351	.251	.566	.125	.476	.495	.631	.705	.053
.334	.241	.075	.584	.618	.919	.359	.090	.157	.801
.742	.575	.022	.188	.241	.136	.120	.304	.561	.235
.589	.972	.148	.515	.674	.502	.173	.544	.131	.431
.091	.675	.899	.297	.987	.258	.286	.533	.642	.179
.562	.005	.040	.971	.491	.382	.840	.420	.762	.932
.923	.913	.114	.565	.031	.417	.264	.231	.543	.114
.153	.225	.585	.818	.598	.937	.325	.754	.250	.343
.931	.413	.108	.673	.879	.718	.801	.483	.575	.374
.284	.495	.328	.050	.197	.733	.718	.859	.893	.431
.138	.221	.286	.339	.248	.158	.591	.379	.621	.918
.982	.391	.054	.199	.951	.493	.254	.974	.456	.178
.306	.408	.069	.416	.208	.834	.753	.604	.272	.186
.460	.602	.941	.973	.348	.231	.451	.277	.759	.857
.059	.046	.022	.524	.259	.963	.079	.663	.293	.531
.754	.111	.174	.284	.215	.766	.693	.156	.265	.143
.239	.252	.479	.157	.946	.790	.880	.058	.983	.055
.478	.892	.979	.683	.718	.047	.944	.356	.696	.899
.387	.305	.192	.760	.795	.603	.858	.247	.561	.607
.513	.108	.897	.248	.626	.111	.871	.001	.614	.062
.580	.477	.887	.205	.082	.136	.443	.124	.352	.035
.032	.992	.035	.056	.788	.417	.131	.458	.439	.703
.971	.041	.621	.122	.836	.227	.858	.646	.895	.358
.372	.009	.854	.160	.125	.953	.619	.894	.985	.608

RANDOM NUMBER TABLES

.092	.502	.049	.381	.549	.243	.444	.452	.119	.192
.805	.944	.702	.129	.663	.270	.829	.540	.946	.525
.728	.859	.257	.970	.955	.673	.927	.822	.644	.516
.335	.051	.710	.238	.811	.991	.745	.243	.547	.498
.149	.691	.889	.776	.211	.860	.018	.985	.523	.489
.006	.289	.185	.946	.025	.619	.664	.704	.860	.479
.051	.206	.384	.330	.582	.994	.409	.716	.204	.891
.379	.402	.379	.476	.583	.728	.478	.631	.530	.603
.570	.483	.856	.249	.923	.026	.950	.275	.443	.306
.368	.126	.233	.335	.702	.430	.477	.006	.191	.102
.024	.508	.934	.501	.227	.881	.540	.966	.482	.745
.182	.288	.260	.738	.580	.300	.457	.931	.708	.900
.836	.497	.488	.924	.862	.302	.633	.124	.105	.245
.885	.589	.700	.510	.291	.489	.561	.570	.894	.478
.744	.180	.474	.667	.648	.251	.227	.740	.752	.099
.930	.961	.583	.718	.742	.809	.009	.948	.335	.133
.318	.138	.344	.401	.140	.459	.019	.536	.436	.971
.002	.190	.579	.781	.272	.641	.086	.353	.644	.136
.308	.517	.518	.136	.022	.613	.421	.492	.706	.406
.979	.504	.670	.660	.099	.363	.905	.853	.029	.035
.506	.758	.913	.095	.408	.324	.923	.238	.453	.286
.697	.839	.549	.878	.178	.538	.879	.774	.446	.714
.972	.473	.745	.188	.580	.738	.466	.214	.363	.928
.299	.216	.414	.370	.184	.080	.251	.251	.260	.741
.958	.863	.912	.012	.219	.201	.384	.291	.661	.633
.142	.784	.288	.910	.049	.644	.327	.345	.535	.310
.433	.412	.427	.996	.174	.318	.931	.006	.345	.263
.717	.976	.232	.083	.936	.094	.092	.391	.953	.688
.919	.370	.939	.575	.765	.539	.619	.308	.705	.829
.324	.637	.533	.659	.026	.617	.348	.218	.935	.463
.015	.004	.485	.594	.102	.942	.726	.295	.328	.489
.870	.204	.854	.547	.527	.552	.958	.454	.024	.689
.433	.152	.722	.656	.224	.358	.385	.667	.156	.647
.082	.502	.347	.393	.303	.295	.637	.307	.507	.689
.119	.057	.188	.474	.713	.138	.689	.004	.255	.903
.297	.713	.871	.658	.215	.353	.876	.045	.765	.864
.157	.625	.036	.503	.078	.692	.624	.003	.607	.793
.643	.307	.060	.358	.537	.642	.270	.356	.966	.279
.155	.229	.990	.097	.161	.265	.910	.277	.907	.218
.193	.216	.001	.810	.159	.401	.483	.175	.622	.374